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Market Incentives for Safety

W. Kip Viscusi

Federal regulation should complement, not contradict, the market forces working to promote safety

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In the heated atmosphere generated by inch-high headlines and multimillion-dollar liability suits, two important facts often get lost. First, society's awareness of what ensuring reasonably complete safety would cost rarely matches the intensity of its demands for such assurance. And second, the most powerful forces working to make products and workplaces safer are not the edicts of government but the dynamics of the market. True, there are situations in which the market cannot by itself create effective incentives for safety, but in the vast majority of cases it can – and does. Drawing on his extensive research into the regulation of risk, the author both describes the nature and extent of those incentives and offers guidelines for identifying the kinds of situation in which they are not likely to operate. For these instances, where federal regulation is essential, the author strongly recommends modes of government involvement that try to duplicate or extend the market mechanism.

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For some time now, government's approach to the regulation of product and process safety has been absolutist and inflexible. Once it identifies a hazard, government usually declares that it is harmful, decides it should be eliminated, and then establishes technology-based standards to cut the perceived safety risk to the lowest possible level. Although meant to promote a no-risk society, this approach has led to much regulation that is unworkable.

In some instances, the ill-conceived nature of these regulations has been obvious all along. Remember, for example, OSHA's early efforts to regulate the shape of toilet seats and to require that workers on bridges wear life jackets even in cases where the riverbeds below were dry. In others, well-intended actions produced unintended results. Clothing manufacturers used the chemical Tris to comply with nonflammability requirements for children's sleepwear; only later did scientific evidence indicate that Tris is potentially carcinogenic.

The point, of course, is not that most safety regulation is so inadequate and misguided or that government has no proper role in promoting safety. The point is rather that without a clear understanding of how market forces place a value on risk and help to reduce it, neither government nor industry can make socially desirable choices – and make them work.

Even the most diehard critics of OSHA would not question the need for government regulation to, say, limit the cancer risks posed by a catastrophe at a nuclear power plant. Where markets are imperfect, a federal presence may indeed be necessary. In practice, however, the real problem has not been to find a legitimate rationale for such regulation but to balance stringency with effectiveness in setting regulatory policy.

When the Environmental Protection Agency began to control air pollution, it imposed an

emissions standard on each point source of pollution. By forcing companies to invest in control measures for each smokestack in a plant, it prevented managers from concentrating their resources in the most cost-effective manner. More recently, the EPA's "bubble" policy has allowed managers to treat an entire plant as a single pollution source and, as a result, to put their efforts where they will do the most good.[1]

Regulatory approaches that permit such trade-offs remain the exception, however. Most health and safety regulations still hinge on narrowly defined engineering requirements and performance criteria. Why? The answer is clear: these efforts reflect a fundamental mistrust of the market and an unwillingness to use the many powerful incentives for safety generated by the decisions of workers, consumers, and companies.

How markets promote safety

In most cases, market decisions will lead to efficient levels of safety if: (1) adequate information about risks is readily available, (2) individuals are aware of the risks they face, and (3) the risks they incur are the result of their own voluntary and informed decisions.

These conditions do not always exist, nor does the market always give companies a financial incentive to promote safety. A manufacturer that dumps its toxic wastes near a municipal water supply creates a potential threat to public safety that purchasers of the company's products are unlikely to experience directly. Hence they will be unwilling voluntarily to pay the higher prices needed to offset a safer waste disposal plan. Similarly, the chemical EDB may pose a risk to consumers of grain products. If, however, consumers are unable to monitor EDB levels, the market mechanisms for promoting safety will not and cannot be effective.

For the market to do an adequate job of regulating safety, all three of the criteria previously mentioned must be satisfied: availability of information, awareness of risks, and voluntary choice to incur the risks. Market transactions that fail to meet these criteria—as, say, in the case of EDB, air pollution, toxic wastes, or nuclear power—leave room for the appropriate intervention of government.

In more extreme cases, for example, there are no transactions to speak of at all. Think, for example, of the genetic damage that the workplace exposure of pregnant women to lead or other toxic substances could cause to the unborn and to children not yet conceived. There is no way the rights and concerns of these future generations can be fairly and fully represented in market decisions about tolerable levels of risk.

Usually, of course, real transactions do take place and do meet the necessary criteria. It is, for example, relatively easy to monitor the risks associated with construction work or work in a sawmill, and individuals can be expected to make well-informed choices about the risks they are willing to incur. Indeed, since the time of Adam Smith, economists have observed that workers will demand extra pay or some other kind of compensation in return for taking on particular kinds and levels of risk.

Wage premiums

At times, labor contracts specify these forms of special compensation. Elephant handlers at the Philadelphia Zoo, for example, receive an annual wage premium of $1,000 because elephants pose a greater risk for handlers than do other animals. In the typical case, wage premiums grow out of job evaluation systems and are not explicitly detailed in collective bargaining agreements. As a result, the only way to estimate the general magnitude of these premiums is to use statistical techniques to analyze large sets of national survey data on employment patterns. My research suggests that, on average, U.S. workers receive just under $1,000 a year for the risks they face.

These premiums reflect both the value workers attach to their safety and the degree to which they will accept trade-offs between dollars and perceived risk. This value, in turn, reflects the implicit financial value workers place on their lives in the face of a known statistical probability of injury or death. A $1,000 premium in a situation where the risk of death is 1 in 1,000 implies a value of life equal to $1,000 divided by 1/1,000, or $1 million. In practice, for workers in high-risk jobs, which pose an average risk of death of 1 in 1,000 each year, the implicit value on each statistical life is roughly $600,000. For blue-collar workers in jobs where the risk of death is 1 in 10,000 each year, the figure is close to $3 million. For individuals in very safe occupations, the statistical value per life can be as much as $6 million to $10 million.

Exhibit I summarizes the contribution of these risk premiums to the wage costs of manufacturing industries. On average, these premiums account for some 6% of production workers' earnings. In relatively safe industries such as chemicals, these costs may fall as low as 3% of earnings, but in industries like lumber and wood products, they rise to 15%. Along

1 See William Drayton, "Getting Smarter About Regulation," HBR July-August 1981, p. 38.

with absenteeism and turnover rates, these premiums can provide managers with a useful barometer of how workers perceive—and feel about—the safety risks inherent in their jobs. Equally important, the premiums give managers strong financial incentives to keep risk levels within reasonable limits. After all, each year industry spends an additional $70 billion on higher wages related to risk, not counting workers' compensation benefits, which add an extra $10 billion.

The force of the market

Compared with these stiff market-driven costs, including the implicit threat of legal action, the financial threat posed by OSHA penalties and the like are not very significant. True, the threat of an OSHA inspection has practical effects, particularly on companies facing an escalating schedule of penalties if they fail to make the mandated changes. Even so, total OSHA penalties for violations of health and safety standards were just over the $6 million level in 1983. The financial incentives for safety that the market created during that period were more than 10,000 times as great. Even highly publicized accidents like the collapse of a cooling tower under construction in West Virginia, which took 51 lives, do not necessarily lead to a huge regulatory penalty. OSHA's fine in the West Virginia case: $108,000.

It is, then, the forces of the marketplace itself, not government regulations, that provide the principal financial incentive to promote safety. As noted previously, these forces work best when safety risks are readily apparent and generate the kinds of accidents that are easy to tally and monitor. Dimly understood health risks with long-deferred effects that affect less aware constituencies are much less suited to the market mechanism. They are, instead, best dealt with through government regulations that alter the incentives of market participants.

Of course, some government actions—for example, the Consumer Product Safety Commission's recent regulation of lawn mowers—needlessly address risks that the market can handle effectively. Based on the commission's own calculations, the benefits of improved foot probe guards and a "deadman" control device requiring continuous contact with the mower handle are not worth the regulation's $200 million annual cost.

To be sure, the market may fail if participants do not read the signals that risk generates. Companies will often, for example, devote considerably greater attention to the well-publicized costs of product liability lawsuits, which average only $225,000 per fatality, than to the risk premiums generated through wages and prices, which are an order of magnitude larger but have no explicit price tag associated with them. This emphasis on product liability instead of on market valuation of safety led the Ford Motor Company to place a statistical value on lives lost through gas tank explosions in the Pinto at $200,000 each and, as a result, to conclude that safety improvements were not worthwhile.

Better understanding of how consumers value safety should lead to better safety-related decisions. Nevertheless, there will always be situations in which consumers do not fully understand risks, companies do not see how the cost of risk may affect them, or the risks themselves operate outside the market—as in, say, the case of pollution. Hence there will continue to be a long-term role for government regulations that complement—but do not contravene—the role of market forces.

Tamper-resistant packaging

One of the most striking recent examples of how the market works to promote safety is tamper-resistant packaging. After seven Chicago area residents died from taking Extra-Strength Tylenol capsules that had been poisoned, the Food and Drug Administration issued extensive packaging requirements for over-the-counter drugs and cosmetics. Even in the absence of government action, it seems likely that companies would have made some such changes in packaging, but risk levels were sufficiently small that consumers might not have had enough information to make sound decisions. In addition, by helping to establish a benchmark for reasonable protective actions, the regulation reduced the threat of product liability lawsuits. On balance, then, was the regulation worthwhile?

The answer depends, of course, on the assessment of overall costs and effects. At the least, a regulation should be in society's best interests and/or its benefits should exceed its costs. That the Office of Management and Budget now requires this test for all new regulations (except when the agency's legislation prohibits the test) is, in effect, the government's way of asking whether the regulation would pass a market test if consumers fully understood the risk. That is, if they fully understood their benefits, would consumers be willing to pay the cost of putting better seals on containers sold over the counter?

On the cost side of the equation, the Food and Drug Administration estimated that the new packaging requirements would affect nearly 2 billion containers a year. At 1 cent to 2 cents per container, the total bill would be approximately $31 million. Thus, if

the Chicago poisonings were otherwise an annual event, the regulation would save lives at a cost of $4.4 million per life – a figure roughly comparable to the average statistical value of life for workers in hazardous jobs.

These calculations do not offer grounds for a clear-cut endorsement or rejection of the FDA's policy. The expense of protecting such packages is not wildly inappropriate, nor is this policy's goal so desirable that it would be attractive even if it cost more or were a bit less effective in preserving life. In practice, the real benefits of the FDA's response have grown out of the speed with which it has acted. Without the quick establishment of guidelines for protective packaging, affected companies would have had to defer improvements or risk adopting systems in conflict with what the FDA ultimately required.

For consumers, the speedy action did much to alleviate anxieties that distorted their market preferences, but these distortions showed the true force of the market in creating incentives for safety. In the aftermath of the tampering incidents, Tylenol lost 87% of its sales. The sheer size of this response dwarfed any incentives for safety that the tort liability system created. Had the seven deaths resulted from its negligence rather than from tamperings, Johnson & Johnson would have faced much smaller financial penalties than those the market generated. If we can judge from the typical product liability awards for wrongful deaths, Johnson & Johnson would have paid less than $2 million if it had been found liable for all seven deaths.

To its great credit, Johnson & Johnson's response to the incident was in no way tentative. The company firmly reestablished Tylenol's acceptance among consumers by introducing a protective packaging system that created three barriers to potential tampering – an approach that went well beyond that imposed by the FDA regulation.

It is fair to ask, however, if the immense cost of this effort, some $100 million, was strictly justifiable in social terms. After all, there are many other ways to spend $100 million that are likely to be more effective in saving lives – improving guardrails on highways, for example. Moreover, society's interest in preserving Tylenol as a viable brand product, given available substitutes, is not great, although the brand's resurgence may well have discouraged other tampering episodes. The huge amount by which the private, market-based incentives for safety outweighed the public and the regulatory incentives is notable.

Reforming the regulatory environment

To be effective, government policy in safety-related matters must complement the forces of the market rather than attempt to supplant them. Properly structured, the penalties for noncompliance with a government regulation ought to establish financial incentives for safety much like those the market generates.

Carefully drawn incentives foster reasonable trade-offs but not unreasonable and fantastically expensive efforts to reduce all risks to zero or even, as with EPA requirements for ambient air quality, to allow for a "margin of safety" below the zero risk level. Indeed, estimates of the price tag for risk and environmental policies proposed between 1975 and 1980 alone ran from $370 billion to $1.1 trillion (1984 dollars).

The first necessary reform, then, is to recognize that society has legitimate concerns other than risk reduction and that regulatory policies do imply trade-offs among them. Ignoring this need for sensible balance among competing goals may lead to even riskier government policies. The FDA's pharmaceutical testing program, for example, attempts to minimize the risk of a potentially harmful drug going onto the market. In its efforts to err on the side of caution, the FDA incurs a substantial risk of a different type – namely, that a beneficial drug will reach the market slowly or not at all. Some estimates of industry's failure to gain early approval for beta blockers put the annual number of preventable deaths from cardiovascular disease at 10,000.

Along with a more balanced regulatory approach, there is a need for reform in policy design. Federal agencies have, in effect, tried to dictate the technological choices that companies should make. It would be far more productive to give managers the leeway to select the most cost-effective technologies with which to satisfy the market's concern about risk reduction. These choices can make a real financial difference: engineering controls to reduce noise levels in the workplace cost $119,000 per case of hearing loss prevented; protective devices that cut noise by the same amount cost only $15,000 per worker protected.

Greater regulatory flexibility is also desirable. Experiments like the introduction of the EPA's bubble policy remain the exception rather than the norm. OSHA, for example, still imposes expensive requirements for machine guards that are so specific that they pertain to only one-sixth of all machines. President Ford's task force on OSHA tried to remedy these deficiencies by establishing a model performance-oriented standard that gave managers a variety of op-

Exhibit I **Risk premiums as a percentage of total earnings in manufacturing industries***

Risk premiums of 3 % to 5 %	Chemicals and allied products
	Petroleum refining and related industries
	Electrical machinery, equipment, and supplies
	Transportation equipment
	Instruments and related products
	Printing, publishing, and allied services
	Tobacco manufacturers
	Apparel and related products
	Nonelectrical machinery
Risk premiums of 6 % to 9 %	Textiles
	Paper and allied products
	Primary metals
	Rubber and plastics
	Fabricated metal products
	Leather and leather products
	Stone, clay, and glass products
Risk premiums of 12 % to 15 %	Food and allied products
	Furniture and fixtures
	Lumber and wood products

*These premiums are derived from earnings equations that are estimates of the relationship between injury rates and workers' earnings.
From W. Kip Viscusi, *Employment Hazards: An Investigation of Market Performance* (Cambridge: Harvard University Press, 1979); U.S. Bureau of Labor Statistics injury rate data by industry.

Exhibit II **Workers' response to chemical labeling**

	Chemical label			
	Sodium bicarbonate	**Chloroacetophenone**	**TNT**	**Asbestos**
Change in fraction who consider job above average in risk	−35 %	+45 %	+63 %	+58 %
Annual wage increase demanded	$ 0	$ 1,900	$ 3,000	$ 5,200
Change in fraction very likely or somewhat likely to quit	−23 %	+13 %	+52 %	+63 %

Source:
Data from *Table 4* of W. Kip Viscusi and Charles O'Connor, "Adaptive Responses to Chemical Labeling: Are Workers Bayesian Decision Makers?" *American Economic Review*, December 1984, p. 949.

tions for reducing machine-related injuries. Not only would the model standard have saved money; it would also have extended the percentage of machines covered. Unfortunately, but not surprisingly, nothing came of this measure.

Chemical labeling

On balance, however, progress has been made toward engaging market forces – especially the force of better information – directly in the effort to promote safety. The government has long used warning on labels for cigarettes and pesticides as an alternative to banning these risky products. Chief among the newer uses of information is OSHA's chemical-labeling policy, a prime example of how public policies might be more effective if they took advantage of the constructive role of the market.

With its price tag of $3 billion, OSHA's hazard communication proposal is the most expensive risk regulation the Reagan administration has issued. Its goal is to place warning labels on containers of hazardous chemicals so that workers can take appropriate precautionary action and companies can give prompt and appropriate medical attention to individuals improperly exposed to the chemicals. This approach represents a dramatic shift in the tenor of OSHA policy. In the past, if a hazardous substance was present in the workplace, OSHA mandated that it be reduced to the lowest technologically feasible level.

So uncompromising a policy is simply untenable. Scientific evidence shows that more than 2,000 substances in the workplace are potentially carcinogenic. If OSHA chose to control these substances on a case-by-case basis, merely developing the regulations would take decades. Indeed, given OSHA's pace in setting new health standards, the process might well take several centuries. How much more sensible, then, to use the risk-reducing capacity of workers' and managers' actions.

Companies in the petroleum and the paint and coating industries, for example, have already adopted such labeling programs to promote safety and to cut product liability costs. Communicating information about potential hazards and suitable protective equipment to workers will help them distinguish the situations in which special care is necessary. Communicating this information also has the benefit of making the companies themselves aware of the hazards that these substances pose and is thus more likely to promote the use of safe practices.

To investigate further how chemical labeling influences the actions of workers, Charles O'Connor (a chemical labeling consultant) and I conducted an experiment in which we monitored worker

response at several plants to four different chemical labels. One of the chemicals was safe (sodium bicarbonate); the remaining three were risky (chloroacetophenone, TNT, and asbestos). We showed each worker a warning label for a chemical that would replace those with which he or she was then working. As *Exhibit II* indicates, the sodium bicarbonate label led workers to believe that their jobs were below average in risk; the others increased their perception of danger.

This kind of perceptual change helps increase the precautions workers take. It also leads to a demand for higher pay—in our experiment, to demands ranging from $1,900 to $5,200 annually. If workers have long-term contracts and if job ratings change slowly, wage pressure will not be the most immediate expression of market forces. The market response will show up first in quit behavior. If the asbestos workers in our study did not receive a boost in pay, almost two-thirds of them would be likely to leave their jobs in the next year.

Policies like chemical labeling will trigger various sorts of market forces—changes in risk perception, safety precautions, demands for wage premiums, and worker turnover—and it is up to each company to engage these forces in the most cost-effective way to promote safety. OSHA underscores this flexibility not by requiring a specific labeling format but by requiring companies to educate workers about chemical hazards and to label all hazardous chemicals. Industries that now have labeling programs, such as the paint and coating industry, may continue to use them.

Performance-oriented and market-complementing regulation enlarges the role that business can play in promoting safety at the same time that it creates incentives for managers to understand the connection between the market's interest in safety and profitability. The older standard-based and command-and-control approach has the reverse effect. Bicycles meeting the regulations of the Consumer Product Safety Commission, for example, must bear a tag with the statement, "Meets U.S. Consumer Product Safety Commission regulations for bicycles," and the label must be "at least 6.4 cm (2.5 in.) by 17.8 cm (7 in.) setting forth the required labeling statement legibly and conspicuously in capital letters at least 0.6 cm (0.25 in.) high." Such narrowly drawn policies ignore the constructive possibilities of linking forces with the operation of the market. Neither business nor society can afford to maintain this sort of ignorance.

Politics & economics

...politics differs from economics in three important respects.

First, politics concerns preferences that do not always have a common monetary measuring rod. In an economic market, we seek to maximize our "utility," a goal that substantively can be almost anything but in practice involves things that have, or can easily be given, money values. We may wish to be saints or sinners, to feed the poor or to indulge our basest appetites; but so long as we do these things by consuming more of something when its (money) price goes down and consuming less of it when its (money) price goes up, the economist is indifferent to our ultimate purposes.

...As voters, bureaucrats, or legislators, we may wish to regulate nuclear energy, provide more jobs for the unemployed, reduce the foreign trade deficit, curb inflation, and minimize the cost of government; but we have no way of expressing our choices among these partially competing goals in nonarbitrary, quantitative terms.... Unlike the economic market, where the observer can make the radical but reasonable assumption that each person has the same motive (rational wealth-maximization), in the political arena the observer can note only that each participant wants different things, and sometimes several different things simultaneously, and that each participant assigns a different but impossible-to-quantify value to each goal....

Second, political action requires assembling majority coalitions to make decisions that bind everyone whether or not he belongs to that coalition. When we make purchases in a market, we commit only ourselves, and we consume as much or as little of a given product as we wish. When we participate in making decisions in the political arena, we are implicitly committing others as well as ourselves, and we are "consuming" not only a known product (such as the candidate for whom we vote) but also a large number of unknown products (all the policies the winning candidate will help enact)....

The third and most important difference between economics and politics is that whereas economics is based on the assumption that preferences are given, politics must take into account the efforts made to change preferences. Consumers have "revealed preferences," the origin or value of which is of little importance. *What* people want is thought to arise from outside the market—to be "exogenous." Only *how much* they purchase is affected by the market. But much, if not most, of politics consists of efforts to change wants by arguments, persuasion, threats, bluffs, and education....

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